

STRATEGIC PLAN FOR THE NATIONAL ACADEMY OF SCIENCES: 2020-2025

Our Vision: A nation and world in which people understand science to be foundational in their lives, and recognize NAS scientific advice as the gold standard for evidence-based decision-making that benefits society.

Preamble

The National Academy of Sciences (NAS) has a rich and distinguished history dating from its founding more than 150 years ago. Membership in the NAS is considered one of the premier achievements of a scientist's career, and internationally, other academies look to the NAS for leadership in both science for policy and policy for science. The NAS commands impressive convening power and has access to considerable financial resources to address the issues of our time. As a prominent institution representing the best of US science, there is certainly no shortage of issues the NAS could tackle. The purpose of this plan is to help the NAS prioritize among many projects and issues deserving of its talent, resources, and attention in order to have maximum impact, avoid duplication, and further its mission to recognize and promote the most outstanding science in service to the nation. The Strategic Plan can help the NAS achieve a future in which society recognizes that scientific excellence is essential to human progress and well-being and looks to the National Academy of Sciences to set the standards for excellence.

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Mission Statement

The mission of the National Academy of Sciences is to provide leadership in science for the nation and the world by

- Recognizing and elevating the best science, and fostering its broad understanding
- Producing, and promoting adoption of, independent, authoritative, trusted scientific advice for the benefit of society



Elements of the Plan

The following plan lays out a number of Goals and Objectives. Each objective is followed by notional actions to stimulate ideas from members, staff, and other interested parties as to how

the NAS might achieve the goals and objectives. They are not meant to be prescriptive or inclusive.

Goal 1: Address critical societal and global issues by inspiring bold scientific investigation, synthesizing data-driven evidence, and providing authoritative advice.

The National Academy of Sciences, together with the National Academy of Engineering (NAE) and the National Academy of Medicine (NAM), acts through the National Academies of Sciences, Engineering, and Medicine (NASEM) to convene and oversee the National Research Council (NRC), the operating arm of the National Academies charged with generating the consensus reports, workshop proceedings, and other convening activities that provide advice to the nation. As the senior partner in the NRC, the reputation and resources of the NAS cannot be distinctly separated from the success of the NRC. Therefore, it is a national imperative that the NAS cultivate the intellectual, human, organizational, and financial resources to ensure the success of the NRC, and help translate ideas to actions. The following objectives are designed to achieve this goal.

Objective 1a. Catalyze actions. The NAS must find an equilibrium position between a stance of being overly passive (handing off a report and hoping that someone notices it) and being overly aggressive in pushing an agenda, regardless of whether stakeholders are engaged. Mindful that science must serve society, not any particular administration, the following are possible candidate actions that would allow the NAS to support the use of science in policy more actively.

- Proactively address timely issues by launching critical studies in advance of receipt of external funding for a study. The Academies have a long-standing policy of being able to do this once external funding for that study reaches a critical threshold, calling principally on the endowment of the NAS to cover the shortfall until full funding is reached or in the event that it is not. Should that trigger point be reconsidered? Can more flexibility be introduced for studies that are particularly time sensitive?
- Communicate findings and recommendations from still-current reports through diverse channels each time there is a relevant world event. Part of catalyzing action is ensuring that information is available in sync with world events. At present, reports are communicated when first released with a roll-out plan that depends on the interest of the sponsor in publicizing the findings and conclusions. Many sponsors are unsure at the time of funding whether they want to publicize the report or do not prioritize communications. The initial rollout rarely coincides with a major national or international event that relates to the topic of the report. When such an event does occur, there is no budget to resurface the findings and conclusions into the current news cycle, using the report for its original intended purpose: to guide and inform. What alternative funding strategies could be developed for communicating the results of the important work of the NRC?
- Issue joint statements from the three Academy Presidents to speak with one voice on current issues addressed in Academies' reports. Recently, the presidents of the three

Academies have begun issuing joint statements on scientific topics of national and international interest to prompt appropriate (or prevent inappropriate) action in response to urgent issues. Examples include statements on [the safety of childhood vaccinations to protect against infectious diseases such as measles](#), [the risks of separating children from their parents as a part of border security strategy](#), and [the strong evidence backing anthropogenic climate change](#). To maintain the impact of such statements, the intent is to issue them rarely, only on subjects of great import where the science is clear, and only when the National Academies have weighed in previously with a consensus finding on the issue. However, it does require resources to issue impactful statements, most notably to create the public-facing web resources that distill the science to the level that is understandable to the lay reader. For example, the climate change statement benefitted from the prior work underway under the [Climate Communications Initiative](#). The NAS must be proactive in identifying timely topics and in generating appropriate web content, an example being *The Science Behind It*, a new communication project to explain what science concludes about important issues that interest people and how those conclusions were derived.

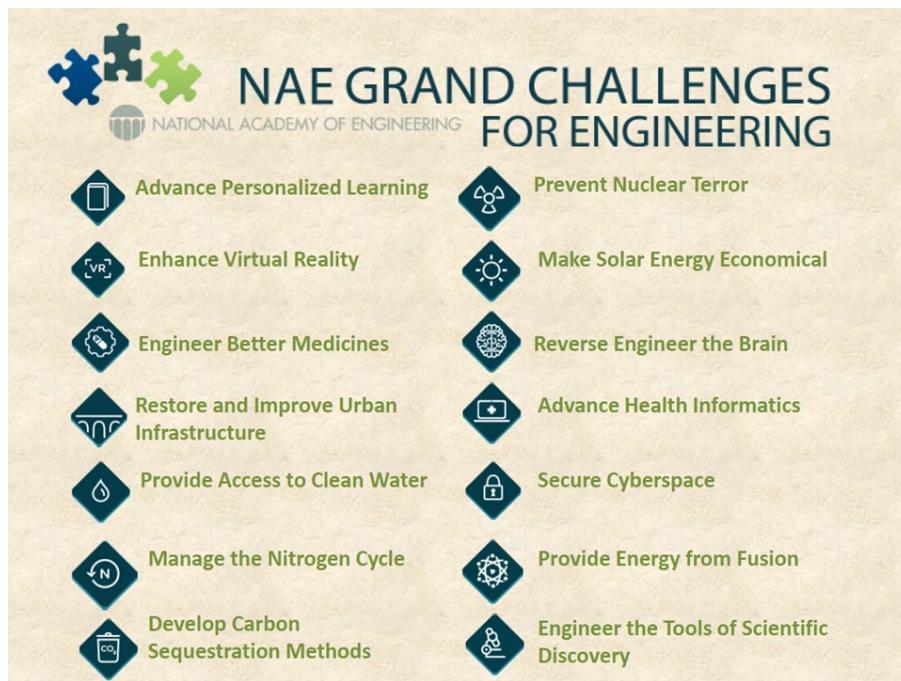
- Expand activities of the [Inter-Academy Partnership-Policy](#) (IAP-P) to connect domestic science policy to similar international issues. While the NRC has significant influence domestically, society benefits when the NAS takes advantage of mechanisms for leveraging outputs from the NRC to catalyze action internationally. The NAS now hosts the secretariat for the policy arm of the Inter-Academy Partnership (IAP), which represents national academies worldwide. The IAP-P undertakes studies and issues reports on behalf of its member academies, many of which are follow-ons to and strongly influenced by NRC reports on similar topics. Recent [examples](#) are reports on responsible conduct in research, a review of climate change science, a sustainable energy future, and the sustainable development goals. Continued hosting and investing in the success of the IAP-P is one approach to multiplying the influence of the NRC internationally. Are there others?
- Activate international members on issues of global interest. A vastly underused resource within the NAS to catalyze science in service to society is the international membership. International members are chosen not only for the scientific achievement, but also for their influence and prominence within the scientific and leadership circles within their nations. Despite this network of powerful, distributed members, there has been no concerted effort to date to draw upon their expertise or connections to advance science-informed policy. Can the NAS develop strategies to remedy this situation?

Objective 1b. Build communities across disciplinary and cultural boundaries, in order to ensure the breadth of intellectual talent necessary to address the challenges of the 21st century. A great advantage of the NAS is its incorporation of all of the natural, life, and environmental sciences, and many of the social sciences. That said, the Academy's own consensus findings argue that solutions to many of society's most challenging issues lie in being able to lower the disciplinary barriers that continue to fragment us and in reaching beyond the sciences to engage with other aspects of human scholarship. Examples of some potential efforts are for the NAS to:

- Promote interdisciplinary, solutions-oriented problem solving that fosters transdisciplinary thinking and convergence approaches on global issues of societal relevance. One specific possibility would be for the NAS to launch a “Grand Challenges in Science” counterpart to the NAE’s [“Grand Challenges for Engineering”](#) (see box).

The NAE Grand Challenges for Engineering

This program is aimed at inspiring young engineers across the globe to address the biggest challenges facing humanity in the 21st Century. From the need to develop affordable clean energy solutions and increase access to renewable environmental resources, to facing new challenges in health care, these challenges are designed to make our world more sustainable, secure, healthy, and joyful. The program is undertaken in collaboration with universities that voluntarily agree to an education program designed around a series of competencies, such as problem focus on addressing the grand challenges (rather than a disciplinary focus on mechanical or software engineering), an exposure to multicultural viewpoints, training in ethics, and an emphasis on social consciousness.



- Reform class/section structure to remove artificial barriers to electing the best. Nearly every NAS class and section officer has identified the shortcomings in the current election procedures that candidates whose contributions fall between section boundaries may be at a disadvantage to get nominated, and those who fall between class boundaries are surely at

a disadvantage to be both nominated and elected. How can these flaws be addressed so that the NAS includes the best the nation and world have to offer, regardless of field?

- Engage with the arts and humanities to expand reach and impact to new audiences. The NAS must look outward as well in its community building. Science needs to be relevant to the public at large, not just the science-loving members of the public. Which collaborations with the arts and humanities are effective vehicles for inspiring an appreciation for or interest in the sciences?

Objective 1c. Increase capacity in the US and abroad. Talent is always in short supply. The NAS, while representing the elite of American science, has a responsibility to nurture tomorrow's scientific leadership. A few potential actions to achieve this objective include:

- Build leadership skills among young scientists. Promising young scientists rise to their full potential when they are put into positions of ever-increasing responsibility, are exposed to mind-expanding topics, learn how to communicate to broad audiences, and are allowed to build collaborations with diverse researchers from other cultures. A long-running NAS program that achieves these objectives is the [Kavli Frontiers of Science](#), along with its many bi- and multi-national versions (see box). The [New Voices](#) program builds leadership skills among rising stars while helping to diversify the NASEM. Can additional funding for these programs be found to meet the demand and to accommodate all of the researchers who could benefit from the experience?

Kavli Frontiers of Science Symposia

The Kavli Frontiers of Science symposia bring together outstanding young scientists to discuss the research frontiers in fields across the sciences, helping scientists become more conversant in the exciting new developments driving forefront discovery in other disciplines. The format encourages both one-on-one conversations and informal group discussions in which participants continue to communicate about insights gained from formal presentations and the excitement of learning about cutting-edge research in other fields. The Frontiers program helps to remove communication barriers between fields and encourages collaborations. Multi-national versions involve Germany, China, Japan, and other nations. A young researcher might first attend as a participant, then as a speaker, and finally as a member of the organizing committee. More than 10% of the current NAS membership is drawn from the Frontiers alumni.



- Increase representation of underrepresented minorities in science. Increasing capacity in the US requires that the nation be able to draw upon all of the talent available to contribute to the science and technology (S&T) enterprise. Currently, the S&T workforce does not mirror the racial, gender, or geographic diversity of the nation. Can the NAS help to

understand and eliminate the barriers that prevent equal access and opportunity for all to excel in the S&T workforce?

- Work with international academies. The NAS has many opportunities to partner with foreign academies to promote science, provide authoritative advice, and encourage the next generation of researchers. To date, decisions on which opportunities to pursue have been driven by the availability of funding, rather than some larger strategic framework. Should the NAS adopt a more strategic approach to how its activities are contributing to capacity building and to other priorities in this plan?

Goal 2: Improve public understanding and appreciation of science and the scientific method.

The NAS cannot expect to influence leaders on the importance of science-based decisions if the public at large does not understand or appreciate the value of science or the process by which scientific conclusions are reached (e.g., science as distinct from religion or a belief system). There are many organizations involved in science communication, including informal science museums, science programming, and outreach programs from many federal agencies. Specific objectives in this area appropriate for the NAS are:

Objective 2a. Expand new, diverse, and effective channels of communication. Science communication must begin by developing the best communicators and methods, whether within the ranks of scientists or other communications professionals. Some example activities in this area include:

- Foster the science of science communication. Science communication can and should be approached as a research topic to help scientists learn to more effectively communicate with non-experts. How can the NAS best support this community of researchers and help advance their findings?
- Reward science communication. NAS prizes and other recognition can be given to scientists, journalists, filmmakers, and others who accurately and effectively communicate science to non-science audiences through a variety of media. Such recognition is highly valued and raises the profile of these contributors and their contributions.
- Disseminate best practices. While workshops can help provide appropriate forums for discussing advances in science communication, the NAS could investigate more efficient channels for disseminating best practices to students, early career researchers, their mentors, and professional communicators. Which methods scale with the size of the audience and show effectiveness?

Objective 2b. Promote the understanding of science. One goal of science communication should be to demystify science and build public appreciation for the contributions of science to their quality of life. Possible actions are:

- Engage the public in how science impacts their lives. [LabX](#) is a new NAS program that seeks to empower young adults to use science to make smart decisions in their daily lives using games, theatre, and other activities as a draw for an audience that might not normally seek out a science-based event. Is this approach effective and useful for other audiences as well? Does it scale?

- Support the adoption of the Next Gen Science Standards in schools. In 2012, the National Academies produced the [framework](#) that led to the Next Generation Science Standards for K-12 students. To date, twenty states and the District of Columbia have adopted the standards, representing 41% of students in America. What more could the NAS do to promote adoption? What role could state-based members play in encouraging adoption in states that have yet to sign on?
- Improve portrayal of science and scientists in popular media. The NAS's Science and Entertainment Exchange connects entertainment professionals with scientists to create a synergy between engaging storytelling and accurate science (see box). What is the right scale for this program, given new outlets for media?

The Science and Entertainment Exchange

Centered in Los Angeles and New York City, Exchange events include “speed dating” between scientists and industry professionals, coffee-house conversations, improv experiences, and full-on retreats. The Exchange has served as a match-maker between major Hollywood blockbusters and scientists with relevant expertise to help ensure that the productions remain as true to the real science as is practical within the limits of entertainment. Below are some recent consults.



Objective 2c. Build an understanding of and confidence in science and the scientific method. If the public does not understand the methods of science, they will have little reason to assert that scientific results have any stronger basis than teachings from religion or from their intuition. Some possible approaches for the NAS to build confidence in science and the scientific method include:

- Trace the useful outcomes from research. Science must be more than a belief system, because it has repeatedly and systematically led to predictions that have improved our lives measurably. The NAS has periodically produced content (documents, web pages,

videos) in the [Research to Reward](#) series that trace how investments in basic research led to advances that improved our quality of life – important progress that is often taken for granted. While these vignettes have been well done, their reach has been limited. Are there ways to better promote this content or better mechanisms to disseminate this message?

- Accurately portray the process and values of science. Non-scientists are largely unaware of the norms of science – the degree to which debate is encouraged and that merely agreeing with the consensus rarely leads to advancement. The dispassionate nature of science, designed to control bias, is misconstrued by the public as lack of empathy. The NAS has a role in better explaining how science advances and what scientists value.
- Better signal to the public what is trustworthy scientific information. Currently, ferreting out what scientists trust in the published literature is an insider's game. Scientists know how to evaluate the quality of peer review of the journal, the standards of the investigator team, and nuances in the presentation of data and conclusions that separate robust results from suggestive findings. To the public, it all looks the same. Even widely discredited papers of recent vintage can remain in the published literature because “everyone knows” they are wrong, but everyone doesn't include the public. What is the NAS' role in promoting more systematic signaling for the quality of peer review, statistical checks, competing interests declarations, adherence to established methods, availability of data, materials, and code, existence of a replication or registration of the study, etc.?

Goal 3: Improve the culture and practice of science. While the first two goals relate to how the NAS uses and disseminates science in service to society, this third goal is more inwardly directed to the research community. Scientific evidence as an important and unbiased basis for decision making will not be trusted if the community is not vigilant about encouraging and maintaining the highest standards of quality and integrity.

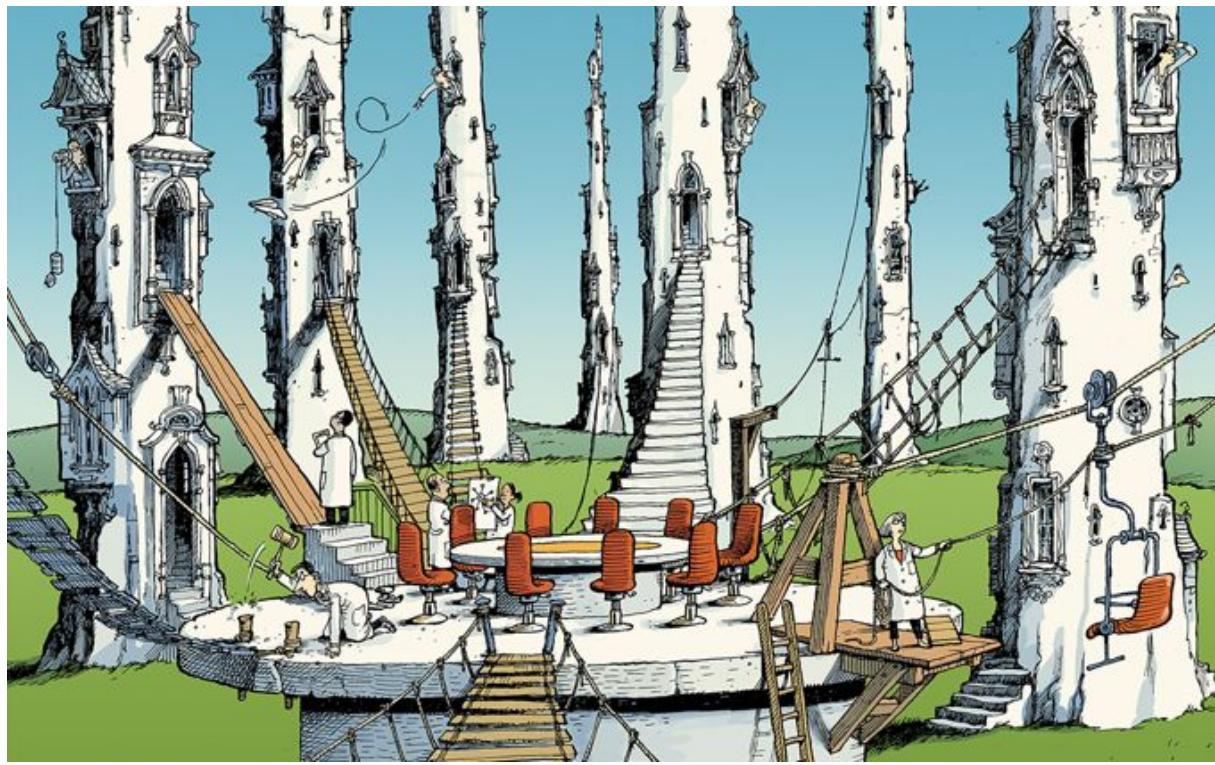
Objective 3a. Set the highest standards for professional conduct. The National Academies have a long history of setting the standards for professional conduct through a series of reports on topics such as [Fostering Integrity in Research](#) (2017) and [Sexual Harassment of Women](#) (2018). However, the NAS should consider actions that would help in the follow through with these reports. Some candidate actions are to:

- Implement a Research Integrity Board. Recommendations from NAS reports on research integrity have been difficult to implement on account of the many stakeholders with overlapping and sequential jurisdiction over the research process, from funding through to publication. There is no one entity that takes responsibility for the entire enterprise. A Research Integrity Board could fill this gap by providing a forum for sharing best practices, a resource for all stakeholders, and an advisory body for building a culture of quality and integrity (see box). While the NAS may not be the ideal permanent home for such an entity, it could at least initiate such a function.
- Incorporate the code of conduct into the culture of the NAS. The NAS has adopted its first Code of Conduct in 2019 setting out expectations for its members in areas of research integrity and respectful relations with other members of the research

enterprise. What actions can the NAS take to ensure that this code becomes part of the NAS culture, and by extension, incorporated in the research community at large?

A US Advisory Board for Research Integrity

Gunsalus, McNutt, et al. published an [editorial](#) in *Nature* calling for the establishment of a Research Integrity Board to share the best practices in ethics, transparency, openness, and research quality across all stakeholders in the research enterprise. The board would focus on robustness and quality, and should function independently of compliance and regulatory machinery. It could take on benchmarking projects, such as comparing the points that institutions include in conflict-of-interest policies. It could also take the lead in vetting or developing resources that will boost quality across all researchers, such as statistical training and checklists for rigor and transparency. There are many perverse incentives in science, and few organized forces to counter them. A research policy board, first recommended more than 25 years ago, will benefit both science and scientists.



Objective 3b. Promote excellence and diversity in the scientific workforce. In addition to increasing capacity (Objective 1c above), attention must be placed on the quality and excellence of the scientific workforce. Examples of actions that could contribute to this objective include:

- Ensure that the NAS membership represents all dimensions of excellence in science: geography, gender, race, and scientific field. NAS members help set standards for excellence within their communities. The NAS should consider outstanding candidates

for election from underrepresented populations, and promote their identification, nomination, and election.

- Support and emphasize the many factors that constitute scientific excellence. Merit-based methods of allocating resources lead to better outcomes than formulaic ones. Yet some organizations, domestically and abroad, still fail to acknowledge the importance of different kinds of merit—including traditional metrics, service, and diversity—to the excellence of science. The NAS needs to continually reaffirm these principles.
- Engage earlier career and more diverse scientists in the work of the NAS. Many NAS programs are designed to engage or communicate with populations that are younger and/or more diverse than the NAS membership. The NAS can look for opportunities to seek out their perspectives as a strategy to make our programs more effective.

Objective 3c. Motivate transformative thinking and experimentation on the professional reward system. The norms that promote the self-correcting nature of science include showing one's work, sharing one's data, controlling for bias, and exposing one's efforts to external scrutiny. Unfortunately, there are subtle but pervasive incentives in the professional reward system for scientists that can undermine these norms. Some possible actions that the NAS could take to initiate community dialogue on how to thwart the disincentives to responsible conduct in research include:

- Promote discussion and consensus on a more complete set of merit indicators for professional advancement. Many discoveries have been enabled by the sustaining contributions of rank-and-file investigators who collected foundational data sets, created instrumental or modeling breakthroughs, or curated special collections. Do peer reviewed scientific publications completely capture all the ways that scientists advance research frontiers?
- Consider including an expectation for service in acceptance of election to NAS, as a signal that with great rewards comes responsibility. Many members recognize that there are other qualified candidates who could have been elected to the Academy in their stead, and therefore take on the mantle of responsibility for service to the nation very seriously. Others are marginally involved. Should the NAS, therefore, consider including an expectation for service when a new member accepts an offer to join the academy, or is it acceptable for a member to merely accept the honor without the responsibility?
- Expand NAS election criteria to include broader indicators of science excellence. Similar to the first proposed action above for this objective, the NAS could consider whether the present format of the nomination for membership is capturing all of the ways in which a scientist could be advancing the frontiers of science. Presently there is nearly a single focus on peer reviewed publications.

Objective 3d. Support the basic research enterprise across all disciplines. The research ecosystem is fragmented into a variety of public and private funding agencies and research organizations. The Academy can provide leadership and coordination by:

- Providing forward-looking decadal surveys that define the new research frontiers and inspire breakthroughs. Decadal surveys have become an important tool for investment

in major facilities, such as satellites, telescopes, ships, brain imaging devices, and observing systems, as well as personnel. The rigorous process for creating them includes community surveys, a process for reaching consensus, and careful review.

- Engaging formally and informally with all stakeholders in the research system to help maintain a healthy research enterprise. With the NAS's presence in Washington, D.C., one of its more important roles is to serve as a neutral and unbiased convener for federal agencies, scientific societies, university leaders and higher-education organizations, industry, philanthropists, scientific journal publishers and editors, and other stakeholders interested in the well-being of the research enterprise. These meetings, both on- and off-record, provide an opportunity for sharing perspectives, exchanging information, and problem solving within the research community.

Appendix 1: Process for Producing This Plan

The need for a strategic plan for the National Academy of Sciences emerged from a discussion at the Council meeting of the Academy in Woods Hole in August, 2018. Further correspondence among the Council members over the fall settled on the plan to involve an outside committee of knowledgeable members of the NAS in drafting the initial plan, with the NAS Council providing review, feedback, and oversight. Council members suggested candidates for the strategic plan drafting committee to provide balance geographically and across various programmatic viewpoints in the Academy and approved the final slate of members.

The Strategic Plan Drafting Committee convened over a long weekend in March at a retreat on the Pima-Maricopa Indian reservation in Arizona to put together the outline of the plan. The membership consisted of:

- Karen Cook, Stanford, Section 53
- David Eisenberg, UCLA, Section 29
- Steven Girvin, Yale, Section 33
- Marcia McNutt, NAS, Section 15
- Margaret Murnane, U of Colorado, Section 13
- Barbara Schaal, Washington U, Section 27
- Christine (Kicket) Seidman, Harvard, Section 42
- Keith Yamamoto, UCSF, Section 22

Ken Fulton provided institutional memory.

Anna Bashkirova planned the retreat and captured the discussion.

The draft plan outline was next presented to Council at the April, 2019 meeting. After incorporating input from Council, the draft was posted on the members-only portion of the NAS website for comment. Members were alerted to the availability of the plan through a variety of means. First, Marcia McNutt mentioned the strategic plan in her annual address to the members at the annual meeting, advising them that it would soon be posted for comment. Next, a direct email was sent to all members from the membership office with a link to the plan. Finally, Marcia also wrote a monthly members' update about the plan, inviting feedback and including a link to the plan.

Several dozen members took the time to comment on the plan, with all comments being exceptionally thoughtful and substantive. These comments were considered by Council at its August, 2019 meeting in Woods Hole before finalizing the strategic plan.